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Avoidance of the 5th Force and Vacuum Energy from Diluted Fermions in Two Measure Theories

Abstract

In spontaneously broken modified measure models, the fifth force problem can be resolved at high density of matter. We also consider a new approach to unify inflation and the late universe with dark energy and dark matter formulated in a model that includes a non-Riemannian metric independent measure and a scalar field with spontaneously broken scale symmetry. Here first of all inflation is possible, which is then followed by a reheating oscillating period and this leads to the formation of all kinds of particles, including fermions, which as the universe expands can contribute to the dark energy and the to the dark matter of the universe in a regime where the density of matter decreases. During the inflationary epoch, we find different constraints on the parameter space associated to the effective potential of the scalar field from the observational data. After reheating the scalar field retraces its trajectory in field space but now the scalar field potential can be drastically modified by the effect of the fermions. In this sense, the present dark energy characterized by its very small value compared to the inflationary phase can be explained by appropriately choosing the parameter space of couplings between the Riemannian and non-Riemannian measures to the fermions.